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*On Respiration.* By William Allen, Esq. F.R.S. and William Hasledine Pepys, Esq. F.R.S. Read June 22, 1809. [*Phil. Trans.* 1809, p. 404.]

*Experiments on Ammonia, and an Account of a new Method of analysing it, by Combustion with Oxygen and other Gases; in a Letter to Humphry Davy, Esq. Sec. R.S. &c. from William Henry, M.D. F.R.S. V.P. of the Lit. and Phil. Society, and Physician to the Infirmary, at Manchester\*.* [*Phil. Trans.* 1809, p. 430.]

Dr. Henry having detected a fallacy in the experiments lately communicated to the Society, in which oxygen gas appeared to be evolved from ammonia by electric discharges, has repeated the experiments with more care, and is now satisfied that no portion whatever of oxygen gas can be separated.

He next endeavoured to detect the production of water, which would equally establish the existence of oxygen as a constituent; and though mere electrization did not enable him to discover the smallest quantity of moisture, he hoped, by exposure of the gas to a freezing mixture, that it might be detected.

But although, by a cold equal to zero of Fahrenheit, a slight degree of moisture was perceptible, even this appearance varied in degree; and Dr. Henry was ultimately convinced, that even this arose from the mercury, or from some extraneous source.

With regard to the quantity of nitrogen and hydrogen gases evolved from ammonia by electrization, Dr. Henry is of opinion that they have been underrated by Mr. Davy, and that the proportion they bear to each other is not exactly what it has been represented. According to Dr. Henry, 100 of ammonia give 198·78; and the proportion of hydrogen to nitrogen is as 71·4 to 28·6 in the 100.

On account of the tedious labour of decomposing any quantity of ammonia by the mere repeated shocks of electricity, the author was induced to seek some new method of operating, and after various trials succeeded to his satisfaction, by detonation with oxygen. When more than three parts of oxygen gas are mixed with one of ammonia, or when so little as only half of oxygen is mixed with one of ammonia, the mixtures are not combustible; but when any intermediate quantity of oxygen is employed, the ammonia is consumed in proportion, and entirely disappears if the oxygen is more than double its bulk.

Dr. Henry, however, discovered an important advantage of using an under proportion of oxygen; for though the whole of the hydrogen is not then consumed, yet the whole of the ammonia is decomposed; for after detonation the remaining hydrogen, and the whole of the

\* This letter, in its original form, was read to the Society, May 18th, 1809; some new observations were added, and some corrections furnished by the author, in consequence of subsequent experiments made in June; it was transmitted to the Secretary for publication July 10.

nitrogen, are in a gaseous state, composing a mixture which may be detonated with a fresh addition of oxygen; and in this way all the hydrogen may be saturated with oxygen, and the nitrogen may be obtained as a final result of the process.

From a set of experiments thus conducted, the proportion of hydrogen to the nitrogen in ammonia was pretty uniformly 70·6 to 29·4; but there was some irregularity in the entire quantities of both, the highest results being as much as 200·6, and the lowest only 182 from 100 of alkaline gas; a difference which Dr. Henry cannot fully explain, but supposes it may arise from absorption of ammonia by mercury, and subsequent liberation by the shock.

The letter concludes with the mention of some experiments on the electrization of carburetted hydrogen, olefiant gas, carbonic oxide, and carbonic acid.

Carburetted hydrogen and olefiant gas were each expanded considerably in bulk; no carbonic acid was generated, but charcoal was deposited on the surface of the tube.

Carbonic acid was also partially decomposed by long electrization, and was converted into carbonic oxide and oxygen; and accordingly carbonic oxide underwent no change by the same operation.

*Some Observations on the foregoing Paper of Dr. Henry. By Humphry Davy, Esq.*

Mr. Davy, having lately had much occasion to pay particular attention to the electrization of ammonia during his researches on the decomposition of nitrogen, has observed various sources of error that may occur in the process, and may account for the difference between his results and those of Dr. Henry.

The first precaution that is to be taken, is to boil the mercury over which the decomposition is to be effected; next to prepare the gas in a separate vessel, and thence transfer it to the boiled mercury for electrization; for unless these precautions are taken, water contained in the mercury becomes the cause of that absorption of ammonia suspected by Dr. Henry, and by thus adding fresh ammonia during the process, occasions a fallacious result.

A second error may also be occasioned, when the mercury has not been boiled, by common air adhering to the sides of the tube.

In a late experiment, Mr. Davy obtained from 15 measures of ammonia 27 of permanent gases, consisting of 73 hydrogen and 27 nitrogen, agreeing so nearly with his original results of 74 to 26, that he conceives either of them to be more near the truth than Dr. Henry's estimate of  $71\frac{1}{2}$  and  $28\frac{1}{2}$ .

With respect to Dr. Henry's attempt to prove the existence of oxygen in ammonia by the formation of water, Mr. Davy does not see much probability of success, as water existing in ammonia may elude any hygrometrical test. And although in his own electrization of ammonia the platina wires were tarnished, at the same time that the ammoniacal gas seemed to lose weight during decomposition, he